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FLOOD INSURANCE STUDY

ORIGINAL

COMPLETED

TOWN OF BOWDOINHAM, MAINE
SAGADAHOC COUNTY

MAY 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 230118

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWN OF BOWDOINHAM, SAGADAHOC COUNTY, MAINE

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Bowdoinham, Sagadahoc County, Maine, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 11. This work was completed in January 1986.

1.3 Coordination

In January 1985, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives from FEMA, the town, and the USGS (the study contractor) to determine the streams to be studied by detailed methods.

During the course of the work, flood elevations and flood boundaries were reviewed with community officials. An intermediate CCO meeting was held in February 1986 at the Bowdoinham town office to review the study in progress.

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On June 19, 1986, a final CCO meeting was held with representatives from FEMA, the town, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Bowdoinham, Sagadahoc County, Maine. The area of study is shown on the Vicinity Map (Figure 1).

Riverine flooding caused by the Kennebec River was studied by detailed methods for its entire length within the corporate limits. Tidal flooding from Merrymeeting Bay affecting portions of the Abagadasset and Cathance Rivers was also studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1991.

Baker Brook, the Abagadasset River, Sedgely Brook, Dennam Stream, West Branch, and the Cathance River were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Town of Bowdoinham.

2.2 Community Description

The Town of Bowdoinham is located in the central part of Sagadahoc County in southern Maine, approximately 23 miles inland from the Atlantic Ocean and approximately 9 miles northwest of the City of Bath. The town is bounded on the north by the Town of Richmond, on the northeast by the Township of Perkins (also known as the Township of Swan's Island), on the southeast by the Town of Woolwich, on the south by the Town of Topsham, and on the west by the Town of Bowdoin. Bowdoinham had a 1980 population of 1,828, an increase of 41.3 percent over the 1970 census (Reference 1). The land area of the town is 39.8 square miles, with an average population density of 46 people per square mile.

Bowdoinham is located in the southern most part of the Kennebec River basin. The Kennebec River originates at the outlet of Moosehead Lake and flows south for approximately 145 miles to Abagadasset Point in Merrymeeting Bay. The Kennebec River is joined by the Androscoggin River and four small rivers before flowing an additional 20.5 miles from Merrymeeting Bay to its mouth at the Atlantic Ocean. The Kennebec River drains approximately one-fifth of the State of Maine.

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LEWISTON
Sabattus
Webster Corner
South Lewiston
Rowes Corner
Lisbon
Lisbon Falls
Blakes Corner
TATE HILL 365 Radio tower
Merrymeeting
Topsham
Brunswick
BRUNSWICK NAS
Bath
Cathance
Days Ferry
Woolwich
Arrowsic
Georgetown Island
Phippsburg
Harding
Cooks Corner
Wardtown
North Pownal
West Durham
South Durham
BRADBURY MOUNTAIN STATE PARK
ANDROSCOGGIN CO
CUMBERLAND CO
SAGADAHOC CO
KENNEBEC CO
Pleasant Hill
Meadows
Radio Towers
Nequasset
Murphy Corner
Edgecomb
North Edgecomb
East Edgecomb
Walpole
West Bristol
Pemaquid Harbor
Pemaquid
Tibbetts
Bay Meadows
Webber Pond
Merrymeeting Bay
Abagadasset Point
Park Point
Swan Island
Green Point
Richmond
Richmond Corner
Bailey Corner
Cedar Grove
Gardiner
Farmingdale
Hallowell
Augusta
Togus
Manchester
Monmouth
Winthrop
Readfield
Wayne
Leeds Junction
Leeds Center
Greene
Greene Corner
Wales Corner
Wales Center
East Wales
Twitchell
Mount Gre
Sabattus Mountain
Maine Central
Maine Turnpike
Androscoggin River
Sagadahoc Company
Lisbon Ridge
Lisbon Center
West Bowdoin
Woodbury Hill
Durham
Topsham
Bradley
Oak Grove
Litchfield
Litchfield Corner
Litchfield Plains
Sabattus Pond
Androscoggin Lake
Wilson Lake
Cobbossee Stream
Kennebec River
Maine Central
Bangor
Lewiston
Auburn
Portland
Augusta
Brunswick
Bath
Rockland
Waterville
Skowhegan
Farmington
Rumford
Bethel
Norway
Oxford
Poland
Mechanic Falls
Minot
Turner
Livermore Falls
Jay
Wilton
Dixfield
Canton
Peru
Mexico
Rumford Falls
Berlin
Gorham
Portland
Westbrook
Scarborough
Saco
Biddeford
Kennebunk
Sanford
Springvale
Alfred
Lebanon
Acton
Shapleigh
Limerick
Waterboro
Newfield
Parsonsfield
Porter
Hiram
Brownfield
Fryeburg
Conway
North Conway
Intervale
Jackson
Bartlett
Glen
Gilead
Bethel
Newry
Mason
Greenwood
Locke Mills
Buckfield
Hartford
Sumner
Canton
Peru
Dixfield
Mexico
Rumford
Rumford Falls
Andover
Upton
Grafton
Errol
Dummer
Milan
Berlin
Gorham
Shelburne
Randolph
Cascade
Jericho
Gorham
Mount Washington
Presidential Range
White Mountains
Androscoggin River
Androscoggin Valley
Androscoggin Lake
Androscoggin Reservoir
Androscoggin Flowage
Androscoggin Dam
Androscoggin Bridge
Androscoggin Ferry
Androscoggin Falls
Androscoggin Rapids
Androscoggin Pond

The headwater lakes and streams that contribute to the discharge of the Kennebec River flow through a mountainous region with peak elevations of as much as 3,000 feet. The central portion of the Kennebec River Valley is characterized as an upland area of rounded hills more than 1,000 feet in elevation. Below the City of Waterville, the river valley widens and elevations are generally less than 100 feet. Between Moosehead Lake and the extent of tidal influences at the City of Augusta, the river falls 1,026 feet in 120 miles, an average gradient of 8.5 feet per mile; from Augusta to Maxwell Island, 21 miles downstream, the average gradient is approximately 1.2 feet per mile. At Bowdoinham, the Kennebec River is a wide, tranquil flowing estuary with a tidal range of approximately 5 feet.

Bowdoinham is located on the northern shore of Merrymeeting Bay. Merrymeeting Bay is a large freshwater bay formed by the confluence of six rivers, including the Kennebec River and the Androscoggin River (Maine's second and third largest rivers). The Kennebec River drains 5,870 squre miles, and the Androscoggin River drains 3,450 square miles. Other minor rivers that flow into the bay include the Eastern, Cathance, Abagadasset, and Muddy Rivers, and they collectively drain less than 200 square miles. The bay itself measures approximately 15 miles in length and varies from 0.5 to 3 miles in width. Depths at mean low-water vary from 2 to 16 feet in the main body of the bay.

Tidal influences extend as far north as Augusta on the Kennebec River to the dams in Brunswick on the Androscoggin River; for the entire length of the Eastern River to the Cathance Road on the Cathance River (mill dam) 1 mile south of Baker Brook on the Abagadasset River; and the full length of the Muddy River.

The Town of Bowdoinham is 71 percent forest, 15 percent agriculture and fields, and 11 percent water areas and wetland (Reference 2). Bowdoinham is primarily a residential community and many of its residents work outside of the town; however, there is some agriculture on the rich and fertile land bordering the shores of Merrymeeting Bay. In the town itself, only a limited number of small, privately owned businesses are found.

The climate of Bowdoinham is typified as humid continental. It has moderately cold winters and mild summers. The average-annual temperature is 43.7 degrees Fahrenheit (°F). The mean-annual precipitation is 44 inches. Water from snowmelt can be a significant source of stream flow during the months of March and April.

Snowfall in the Bowdoinham area occurs primarily from November through April. Yearly totals average 77.8 inches in the Town of Brunswick and 81.8 inches in the City of Gardiner. Augusta, to the north of

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Bowdoinham, has recorded extremes of 106.4 inches in 1955-56, and 29.3 inches in 1952-53 (Reference 3). Snowfall data from the Town of Brunswick and the City of Gardiner, and Augusta can be considered representative of conditions in Bowdoinham.

2.3 Principal Flood Problems

Severe flooding in Bowdoinham is limited to the flood plains of the Kennebec, Cathance, and Abagadasset Rivers and the shore of Merrymeeting Bay. On the Kennebec River, flooding generally occurs in the spring months from rapid runoff caused by heavy rains combined with snowmelt and, less frequently, as a result of hurricanes. Flooding along the shores of Merrymeeting Bay is due to tidal flooding. Significant flooding has occurred on the Kennebec River in past years; however, since the Kennebec River at Bowdoinham is ungaged, no determination of actual flows for these floods is available. Flood flow data for the Kennebec River were taken from gage No. 01048500 at Waterville, gage No. 010490000 on the Sebasticook River, and gage No. 01049500 on Cobbosseecontee Stream at Gardiner.

The flood of March 1896 on the Kennebec River washed out the Gardiner-Randolph bridge, located upstream from Bowdoinham. During the March 1936 flood, which was the flood of record, the Richmond-Dresden bridge was damaged, and huge ice cakes carried by the flood crushed buildings along the banks. It is estimated that the 1936 flood discharge was slightly less than a 100-year event on the Kennebec River at Bowdoinham (Reference 4).

2.4 Flood Protection Measures

The natural streamflow of the Kennebec River is altered by several hydroelectric plants and storage reservoirs located upstream from Augusta. The structure that has the most pronounced effect on the Kennebec River, is the dam at Solon approximately 90 miles upstream from Bowdoinham. It is a low-head dam that maintains a discharge of 3,600 cubic feet per second (cfs) at Madison, 14 miles downstream. When inflow at the dam exceeds 4,000 cfs, it no longer controls river discharges. The major storage lakes within the Kennebeck River basin and their capacities in billion cubic feet are as follows: Moosehead Lake, 23.7; Indian Pond, 3.2; Flagstaff Lake, 12.0; and Wyman Pond, 2.6. These reservoirs have a dampening influence on peak flows downstream.

The most downstream dam on the Kennebec River is at the upper limit of the tidal influence in Augusta. This low-head dam is operated for power generation and to supply process water for mills. Storage from this dam has little effect on downstream flooding.

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The Town of Bowdoinham has adopted the Minimum Shoreland Zoning Ordinance as required by the State of Maine Shoreland Zoning Act. The shorelands located within 250 feet, horizontal distance, of the normal high-water marks of the Kennebec, Cathance, and Abagadasset Rivers have been zoned to restrict development (Reference 5).

Since 1969, flooding has caused considerable damage along the banks of the Kennebec River, especially nearby in the City of Gardiner. During the past 40 years, the Coast Guard has often been requested to break open the channel in the Kennebec River when the ice cover is thick and flood potential is high. These conditions are most likely to occur in the month of March.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for flood plain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Hydrologic analyses for the Kennebec River were carried out using the log-Pearson Type III method to establish the maximum daily mean discharge-frequency relationship for floods of the selected recurrence intervals (Reference 6). Flood-flow data for the Kennebec River downstream from Waterville were obtained from daily records at the power plant now operated by the Scott Paper Company at Waterville. These

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furnished records were published by the USGS at gaging station No. 01048500 at Waterville for the period from 1892 to 1955. Records of maximum daily flows at this power plant for the period of 1955 to 1977 were obtained from the Scott Paper Company. The results from the log-Pearson Type III analysis were increased by 10 percent to simulate instantaneous peak flows. The 10 percent increase was based on a comparison of 10 determinations of instantaneous peak flow over the dam with the corresponding daily mean flow. Because of the increase in drainage area on the Kennebec River from Waterville (4,270 square miles) to Dresden (5,900 square miles), further adjustments were required for the peak discharges to be representative in Bowdoinham. Adjustments for the drainage area were made using records from USGS gaging station No. 010490000 on the Sebasticook River and No. 01049500 on Cobbosseecontee Stream at Gardiner.

A summary of drainage area-peak discharge relationships for the Kennebec River is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 100-YEAR
KENNEBEC RIVER		
Downstream of confluence of Eastern River	5,900	184,000
Pittston-Dresden corporate limits	5,850	183,000

Stillwater elevations for the Merrymeeting Bay were taken from the Flood Insurance Study for the City of Bath (Reference 7).

The stillwater elevation for the 100-year flood has been determined for the Merrymeeting Bay and is summarized in Table 2, "Summary of Stillwater Elevations."

TABLE 2 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 100-YEAR
MERRYMEETING BAY	
At Middle Point	9.4

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the backwater analyses for the Kennebec River obtained from USGS topographic maps (Reference 8). The below-water portions of the cross sections were obtained from the nautical chart for the area (Reference 9).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USGS step-backwater computer model (Reference 10). The 100-year flood profiles were extended upstream from Merrymeeting Bay to Swan's Island, also known as Perkins Plantation. The flood flows were divided and separate profiles were computed around each side of the island (Bowdoinham is located on the west side of the island). The profiles were extended to the head of Swan's Island to ensure convergence to a common elevation at this point. River stationing and flood profiles documented in this report represent data for the Bowdoinham side of Swan's Island only. Results for the east or Dresden side of Swan's Island can be found in the Flood Insurance Study for the Town of Dresden (Reference 11). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The results of the water-surface elevations are tabulated for selected cross sections (Table 3).

The starting water-surface elevations used for the profile determinations were taken from the Flood Insurance Study for the City of Bath (Reference 7).

The backwater model was calibrated using profile information available for the 1936 flood (Reference 4). This calibration was possible because river conditions from 1936 to the present and the structures in the Kennebec River and their alignment, have not changed appreciably.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen on the basis of maps and field inspection at crosssections in the area studied. Channel "n" values for the Kennebec River ranged from 0.040 to 0.055, and the overbank "n" values ranged from 0.070 to 0.100.

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FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH [2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
Bowdoinham-Brunswick-Bath Corporate Limit	----	----	----	----	----	9.4
A	8,650	8,230	121,000	1.5	-18	9.4
B	12,200	5,490	78,700	2.3	-18	9.6
C	15,220	1,760	31,200	5.9	-20	10.0
D	15,910	2,410	38,300	4.8	-21	10.5
E	18,720	5,560	85,500	2.2	-21	11.2
F	21,430	2,050	58,100	3.2	-21	11.4
G	24,490	3,090	60,600	3.0	-21	11.8
H [3]	29,880	1,570	24,100	2.6	-17	12.8
I [3]	35,880	1,330	20,800	3.1	-17	13.6

[1] FEET ABOVE CORPORATE LIMITS

[2] THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

[3] FLOOD DATA FOR THE BOWDOINHAM OR RIGHT CHANNEL OF THE KENNEBEC RIVER AROUND SWAN ISLAND.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

Bowdoinham, Maine
(Sagadahoc County)

100-YEAR FLOOD DATA

KENNEBEC RIVER

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FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH [2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
J [3]	38,410	1,720	24,400	2.6	-10	14.0
K [3]	40,730	1,030	15,500	4.1	- 9	14.4
L [3]	45,130	960	16,600	3.9	-15	15.6
Bowdoinham-Richmond Corporate Limit	45,650	----	----	----	----	15.7

[1] FEET ABOVE CORPORATE LIMITS

[2] THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

[3] FLOOD DATA FOR THE BOWDOINHAM OR RIGHT CHANNEL OF THE KENNEBEC RIVER AROUND SWAN ISLAND.

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

Bowdoinham, Maine
(Sagadahoc County)

100-YEAR FLOOD DATA

KENNEBEC RIVER

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The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year flood plain boundary to assist communities in developing flood plain management measures.

4.1 Flood Plain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. For the flooding sources studied in detail, the 100-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (Reference 8).

For the streams studied by approximate methods, the flood plain boundaries were delineated using the Town of Bowdoinham Flood Hazard Boundary Map (Reference 12).

The 100-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from flood-plain development against the resulting increase in flood hazard. For

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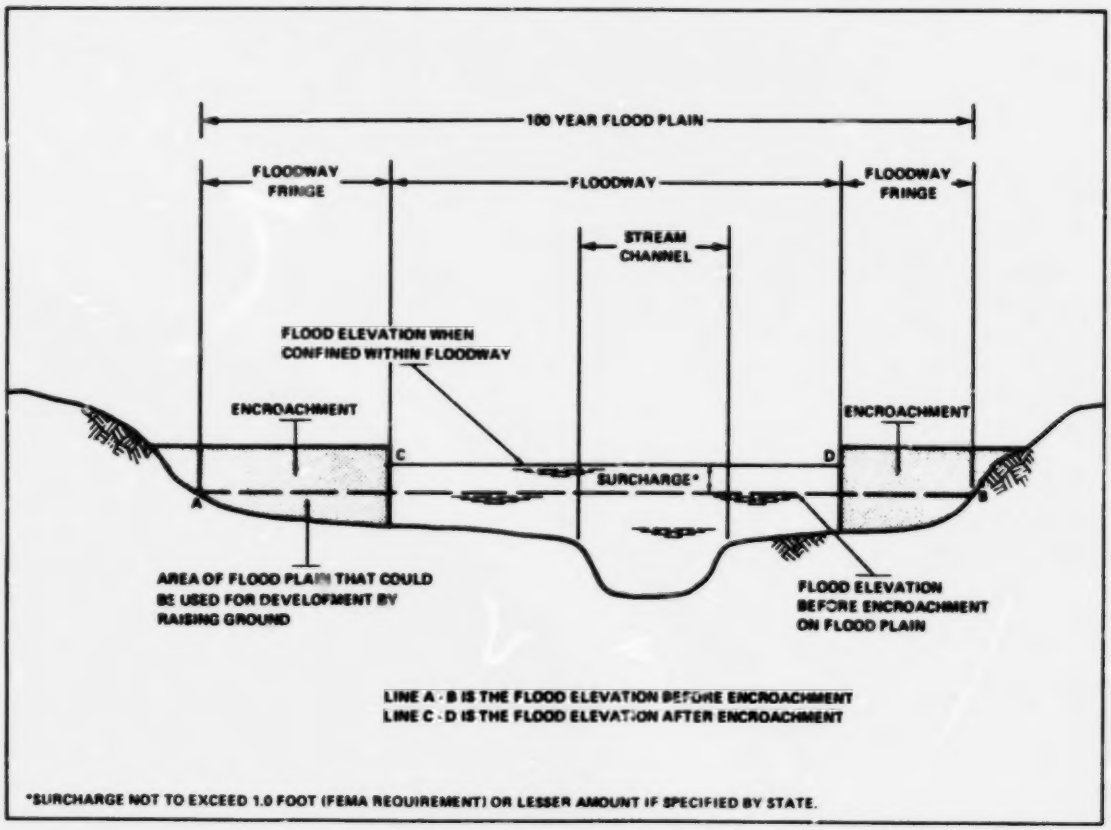
purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Floodway Schematic - Figure 2

No floodways were calculated as part of this study.

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5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year flood plain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

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Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100-year flood plain. The locations of selected cross sections used in the hydraulic analyses computations are shown where applicable.

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7.0 OTHER STUDIES

The Flood Insurance Study for the Town of Dresden is currently being prepared (Reference 11). The results of that study will be in exact agreement with the results of this study.

A Flood Insurance Study for the City of Bath has been completed (Reference 7). The results of this study are in agreement with the results of that study.

Due to its more detailed analyses, the results of this study supersede the Flood Hazard Boundary Map for the Town of Bowdoinham (Reference 12).

The COE Special Flood Hazard Information Report for the Kennebec River was compared to the Kennebec River profiles generated for this study (Reference 13). The profiles did not match between studies. The information in this study supersedes the information in that report due to its more detailed analysis.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

9.0 BIBLIOGRAPHY AND REFERENCES

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4. U. S. Department of the Interior, Geological Survey, Water-Supply Paper 798, The Floods of March 1936, Washington, D. C., 1937.

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8. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet: Richmond, Wiscassett, Gardiner, and East Bowdoinham, Maine, Washington, D. C., 1975.

9. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Nautical Chart, Scale 1:40,000, U. S. East Coast, Maine, Bath to Courthouse Point, Washington, D. C., March 1977.

10. U. S. Department of the Interior, Geological Survey, Bridge Waterways Analysis Model by James O. Shearman and others, Written Communication, Washington, D. C., 1985.

11. Federal Emergency Management Agency, Flood Insurance Study, Town of Dresden, Lincoln County, Maine (Unpublished).

12. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of Bowdoinham, Sagadahoc County, Maine, December 3, 1976.

13. U. S. Army Corps of Engineers, New England Division, Special Flood Hazard Information Report Kennebec River Maine, Waltham, Massachusetts, November 1975.

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EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	*	85.272	A standard disk stamped "T 30 1935" set in the top of a concrete post flush with the ground, 4 feet southwest of a pole, 20 feet north of the north rail, 65 feet west of a road crossing, 128 feet north of milepost P 94-V 207, and 0.5 mile southeast along the Maine Central Railroad from Richmond. The reference mark is located in the town of Richmond.
RM 2	05	6.95	A red paint mark on the north face of the northeast abutment of the Route 24 bridge over the Abagadasset River. The bridge is 3.5 miles northeast of Bowdoinham Village.
RM 3	10	37.050	A standard disk stamped "Q 30 1935" and set in the top of a concrete post flush with the ground, 23 feet north of the north rail, 60 feet northwest of the center of the road, 1.4 miles east along the Maine Central Railroad from the town of Bowdoinham.
RM 4	10	9.824	A standard disk stamped "RESET 1952" set in the top of a lower parapet, 2.7 feet lower than the road, 17.8 feet west of the centerline of the road, in the west end of the north abutment, at the bridge where State Route 24 crosses the Cathance River in Bowdoinham.

*Located outside corporate limits, not shown on maps

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EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 5	10	11.726	A standard disk stamped "P 30 1935" set in top of a concrete post flush with the ground, 3.5 feet west of a whistle post, 11 feet south of the south rail, 30 yards east of the east side of the section toolhouse, 0.2 mile southwest along the Maine Central Railroad from Bowdoinham.
RM 6	*	59.340	A standard disk stamped "N 30 1935", set in the top of a concrete post flush with the ground, 19.7 feet west of the west rail, 40.5 feet northwest of a post marked "Section 12", 40 yards north of an overhead bridge, opposite milepost P 35-y 216, 2.0 miles north along the Maine Central Railroad from Cathance. The reference mark is located in the town of Topsham.

*Located outside corporate limits, not shown on maps

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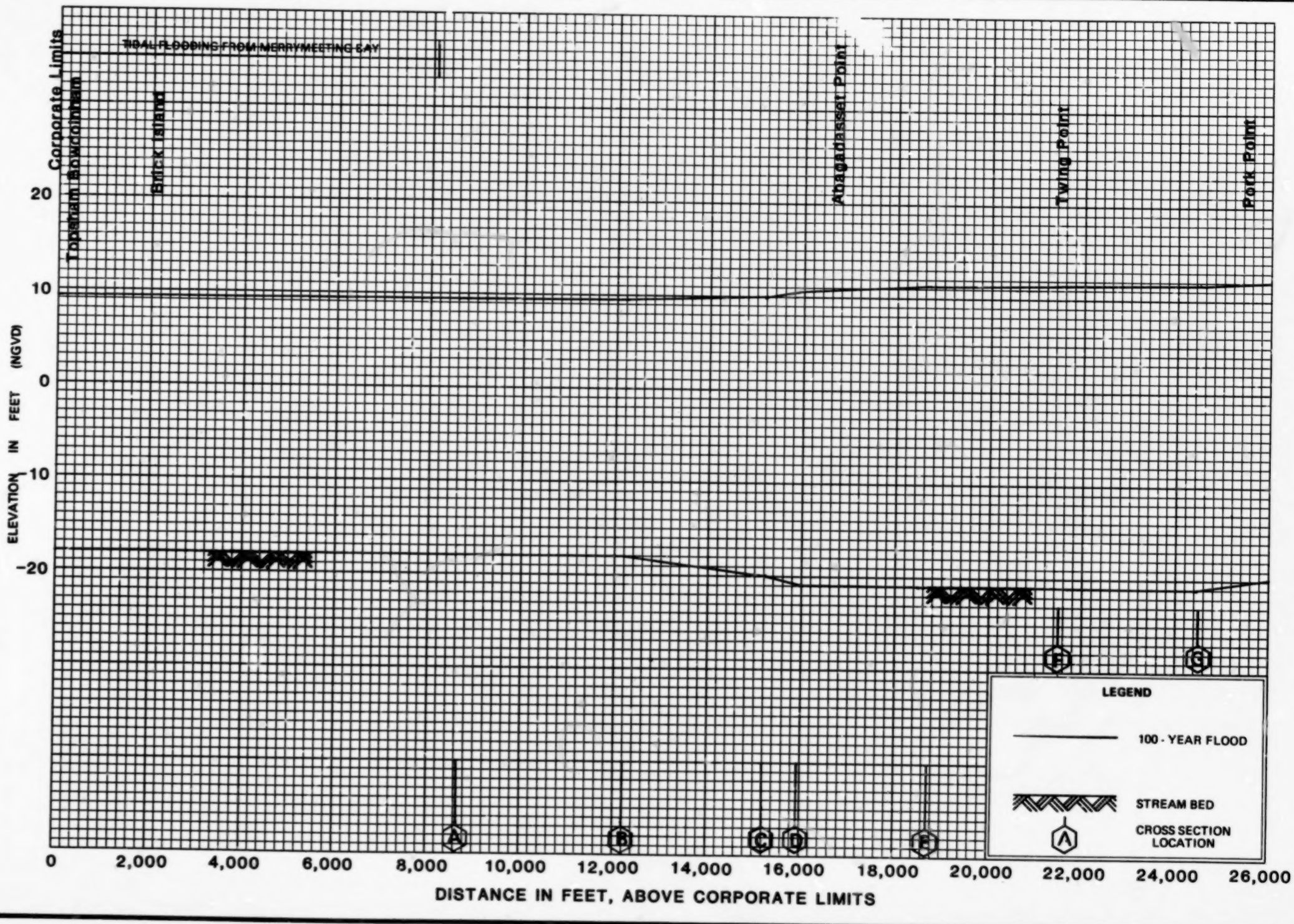

FLOOD PROFILES

KENNEBEC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF BOWDOINHAM, MAINE

(SAGADAHOC COUNTY)

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FLOOD PROFILES

KENNEBEC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF ROWDOINHAM, MAINE
(SAGADAHOC COUNTY)

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